Sustainable energy and air quality for the Northeast US: A policy and planning perspective

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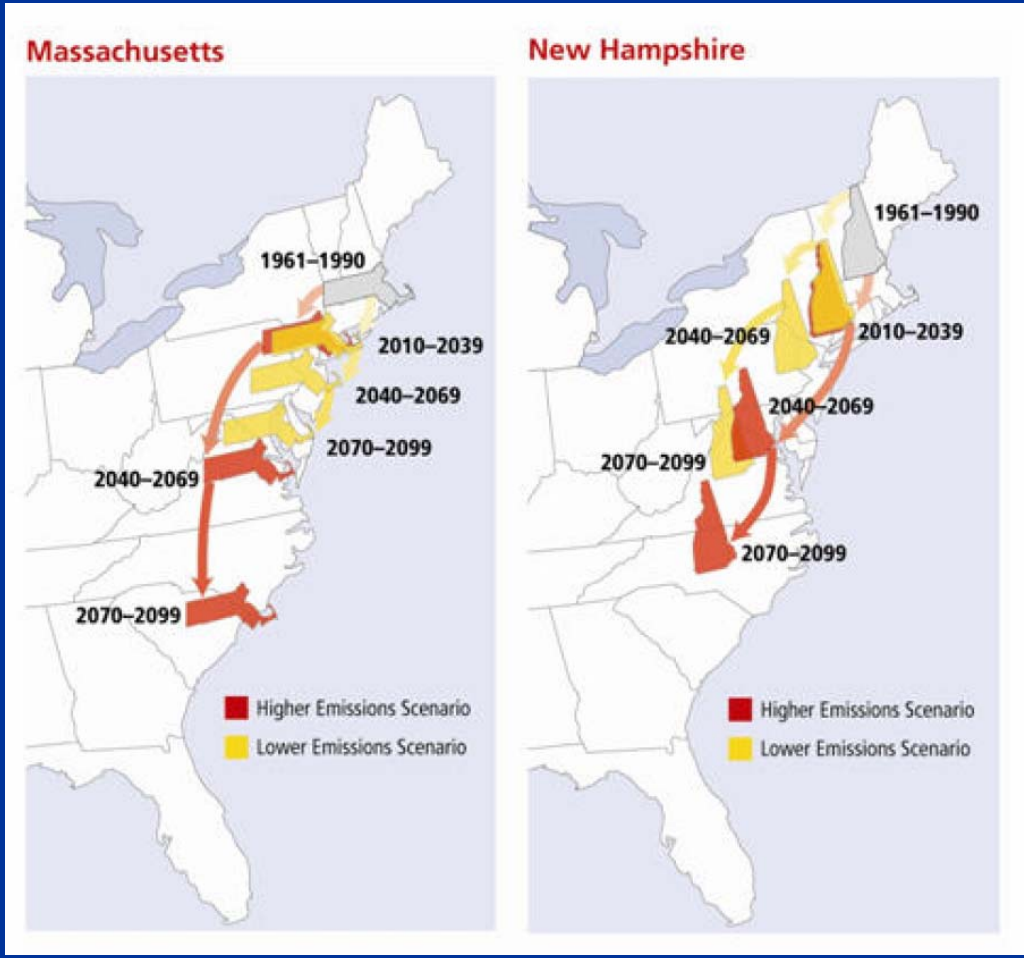
Presentation Outline

- Rationale for integrated energy and air quality planning in the Northeast
- Overview of regional-scale, multi-pollutant policy analysis framework
- Three examples of energy and environmental trade-offs/interactions that a robust analysis should be able to address

Rationale for thinking about alternative energy sources

(What are the challenges to, and opportunities for, sustainable air quality management?)

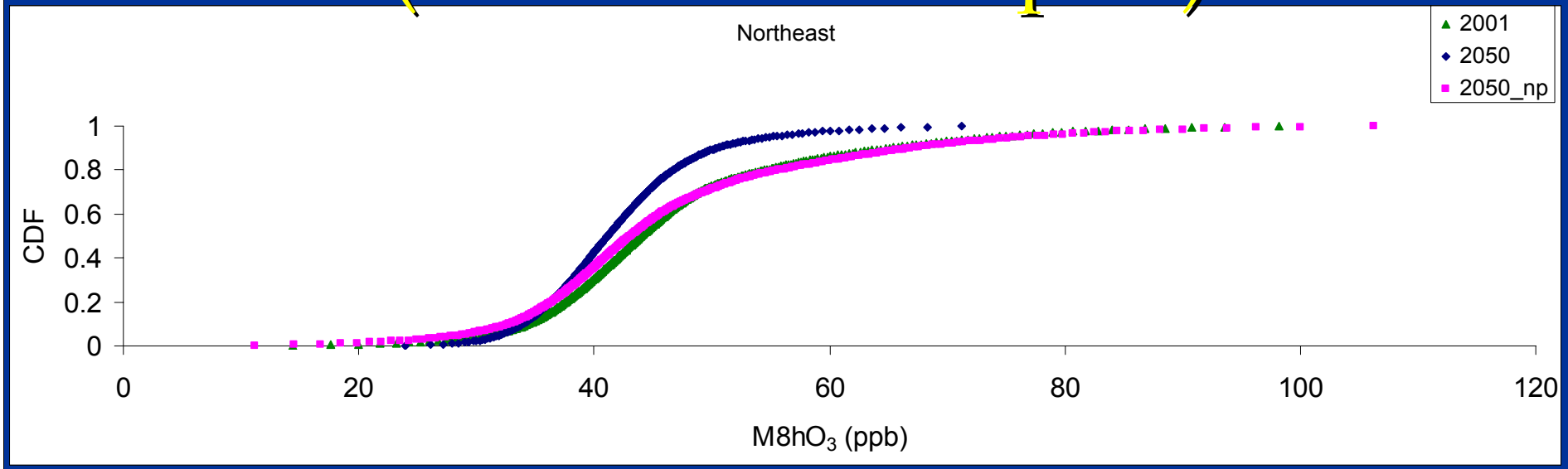
Climate Change in the Northeast

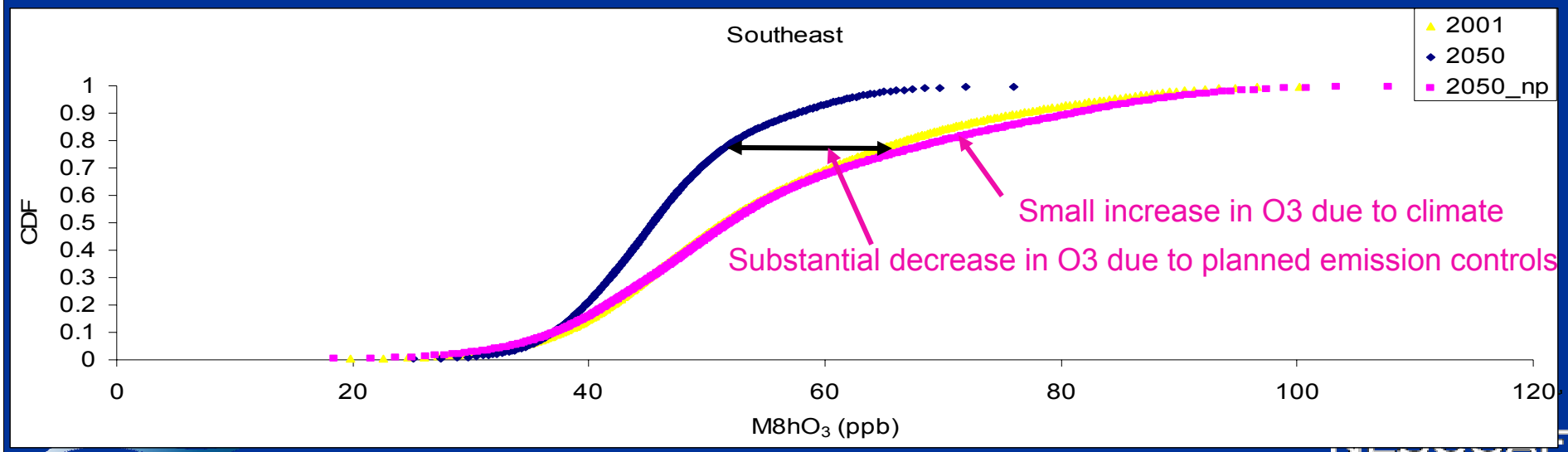


Alternative energy pathways can make a difference in our future climate change "commitment"

Source: UCS NECIA

Climate and Air Quality Links (Link 1 - The Impact)





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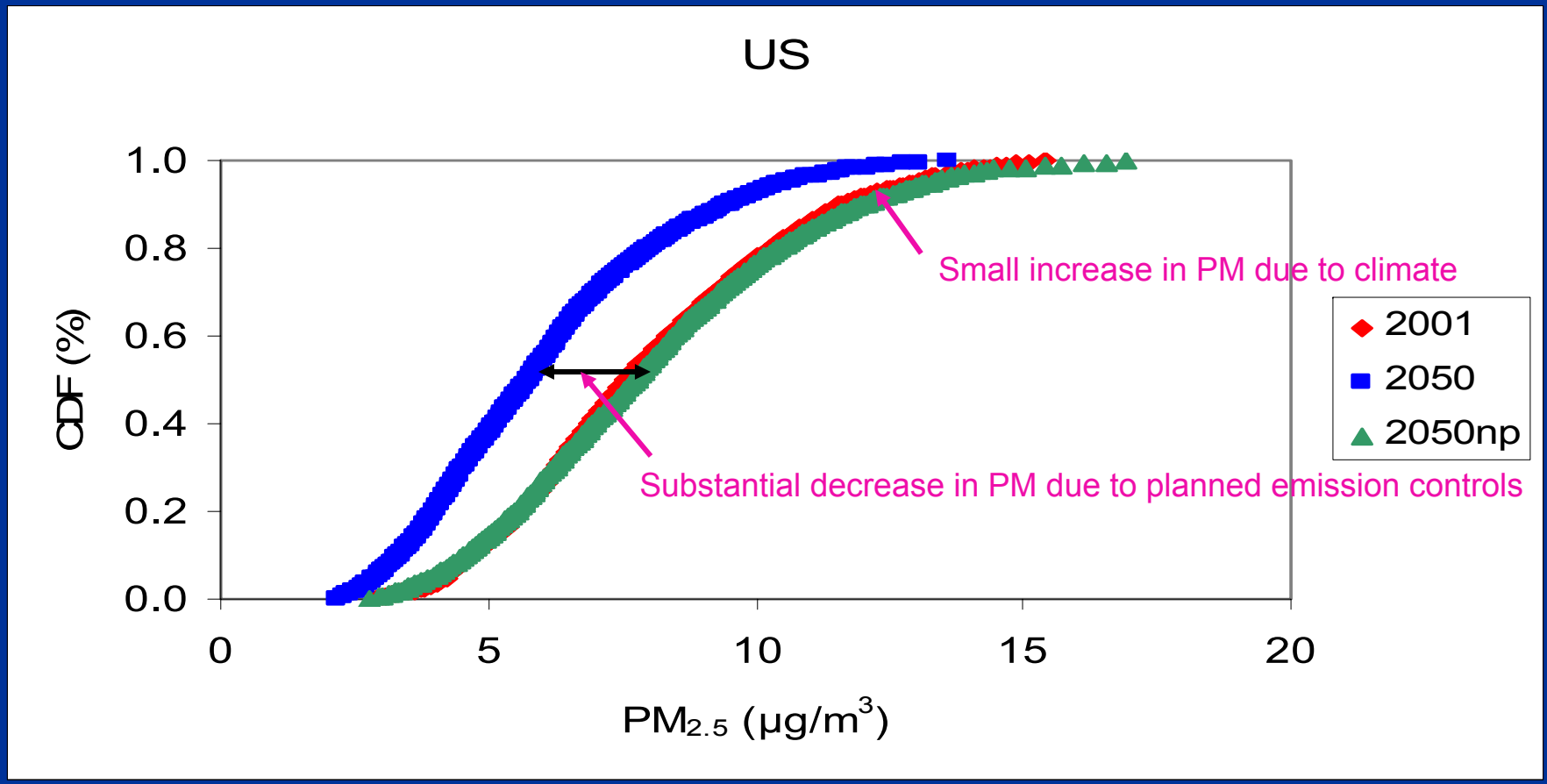
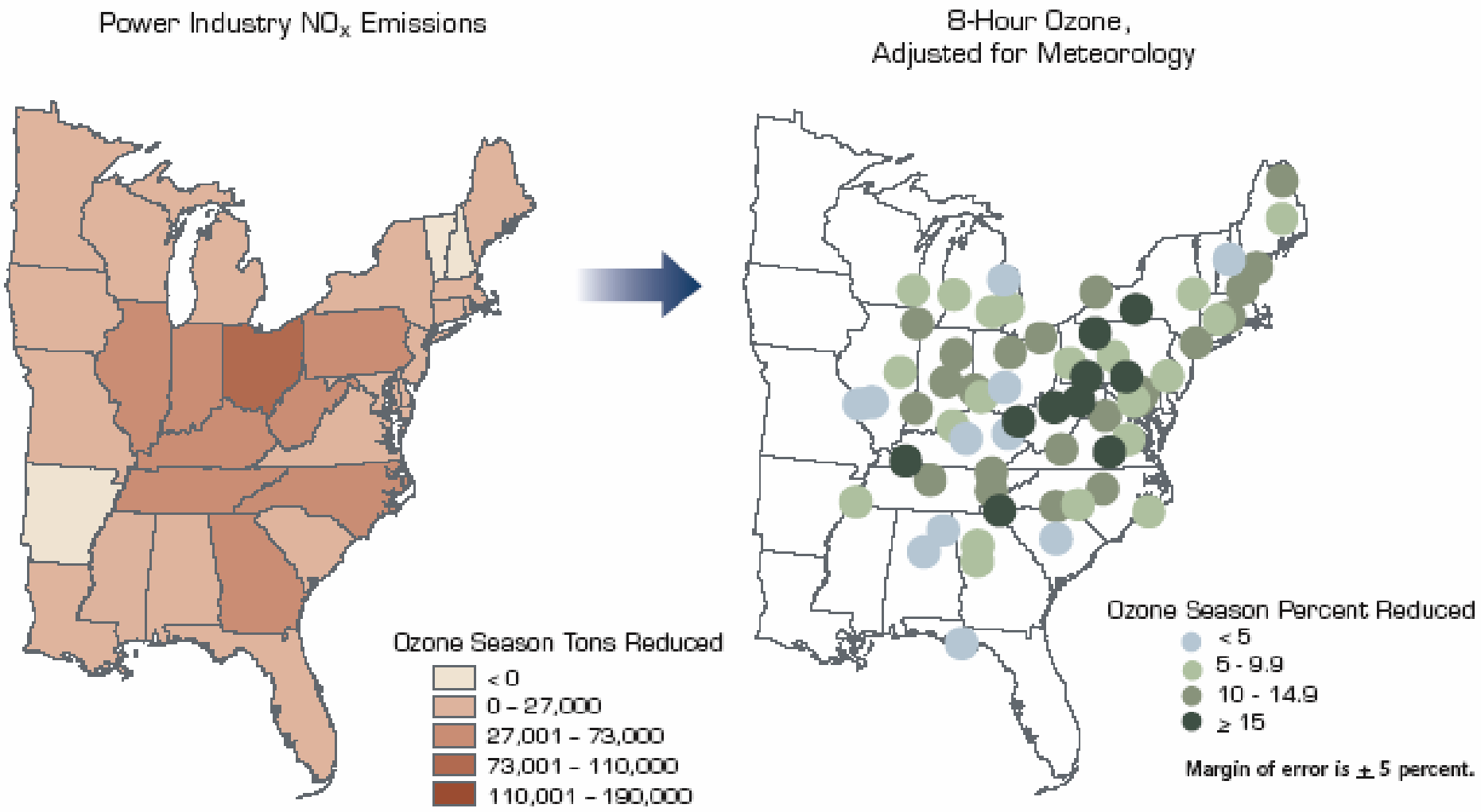


Reductions in Ozone Season Power Industry NO_x Emissions and 8-Hour Ozone, 2002 versus 2004

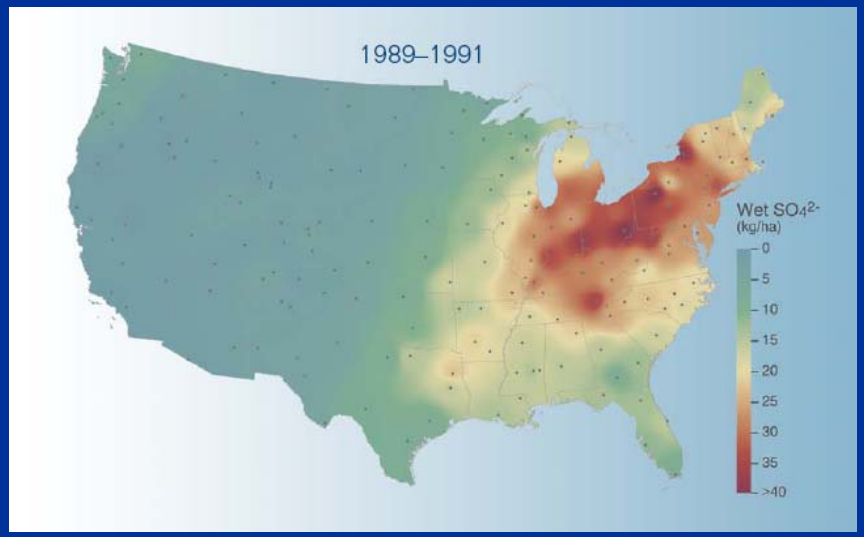


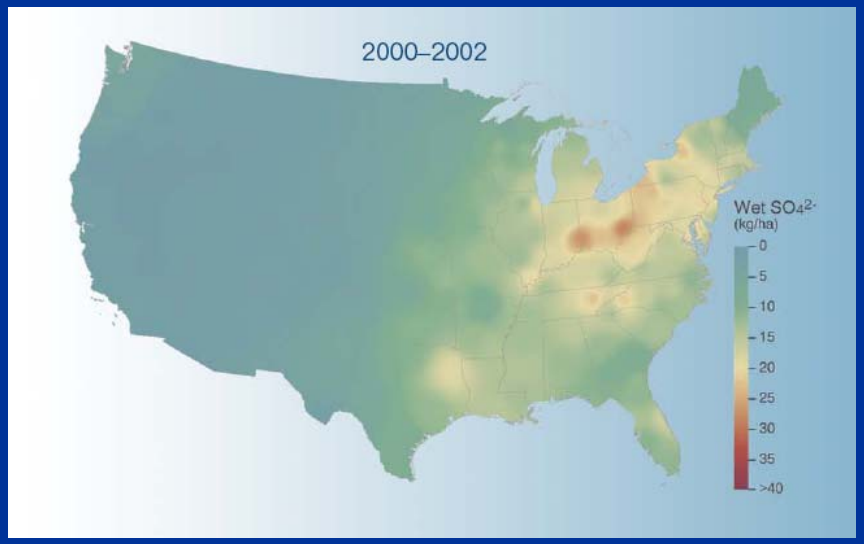
Source: EPA

Notes:

- Darker states show larger NO_x reductions.
- Arkansas (268 tons), New Hampshire (611 tons), and Vermont (16 tons) show small increases in ozone season emissions from 2002 to 2004.

Acid Deposition



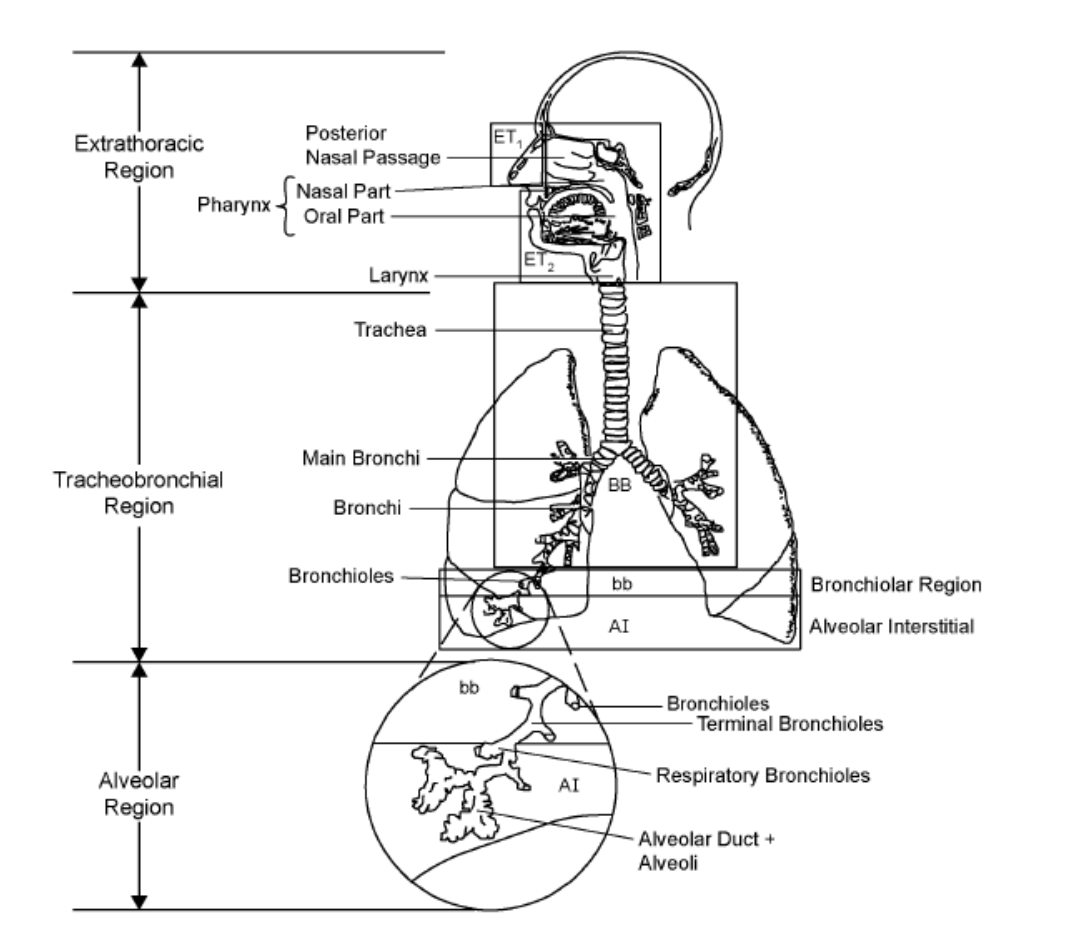


Before Title IV

After Title IV

Source: NAPAP, 2005

Fine Particles and Health

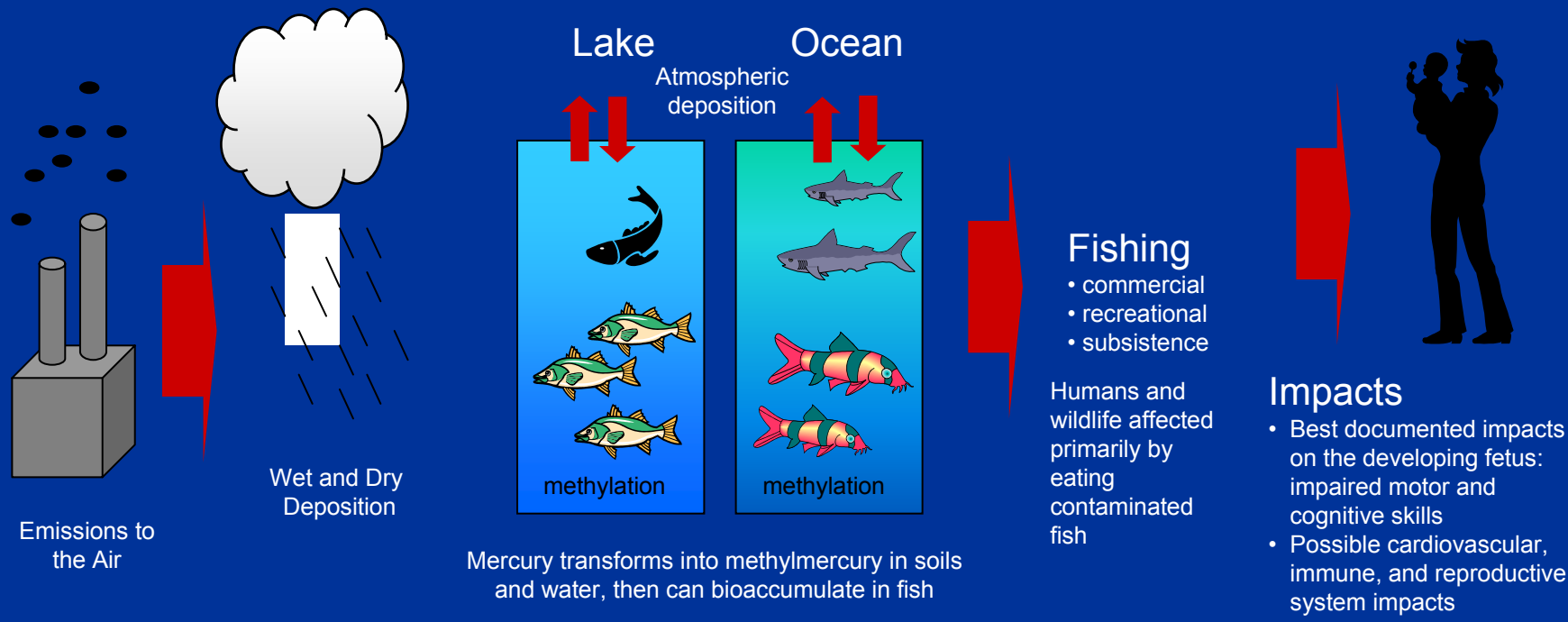


Fine Particles and Visibility

Acadia National Park, Maine

Acadia with high $PM_{2.5}$ loading

Mercury Emissions Contribute to Exposure to Mercury



Emissions and Speciation → **Atmospheric Transport and Deposition** → **Ecosystem Transport, Methylation, and Bioaccumulation** → **Consumption Patters** → **Human Exposure**

- The primary pathway of human exposure to mercury in the U.S. is through eating contaminated fish.
- Power plants emit approximately 48 tons of mercury and are the largest source of mercury emissions in the U.S. (approximately 41%).

Diesel/Black Carbon

Climate and Air Quality Links (Link 2 - The Opportunity)

A Low Carbon Future Could Mean…

- Low NOx future
- Low SO_2 future
- Low Hg and other toxic metals future
- Low Diesel/Black Carbon future

…A more sustainable Future

Multi-Pollutant Policy Analysis Framework (MPAF)

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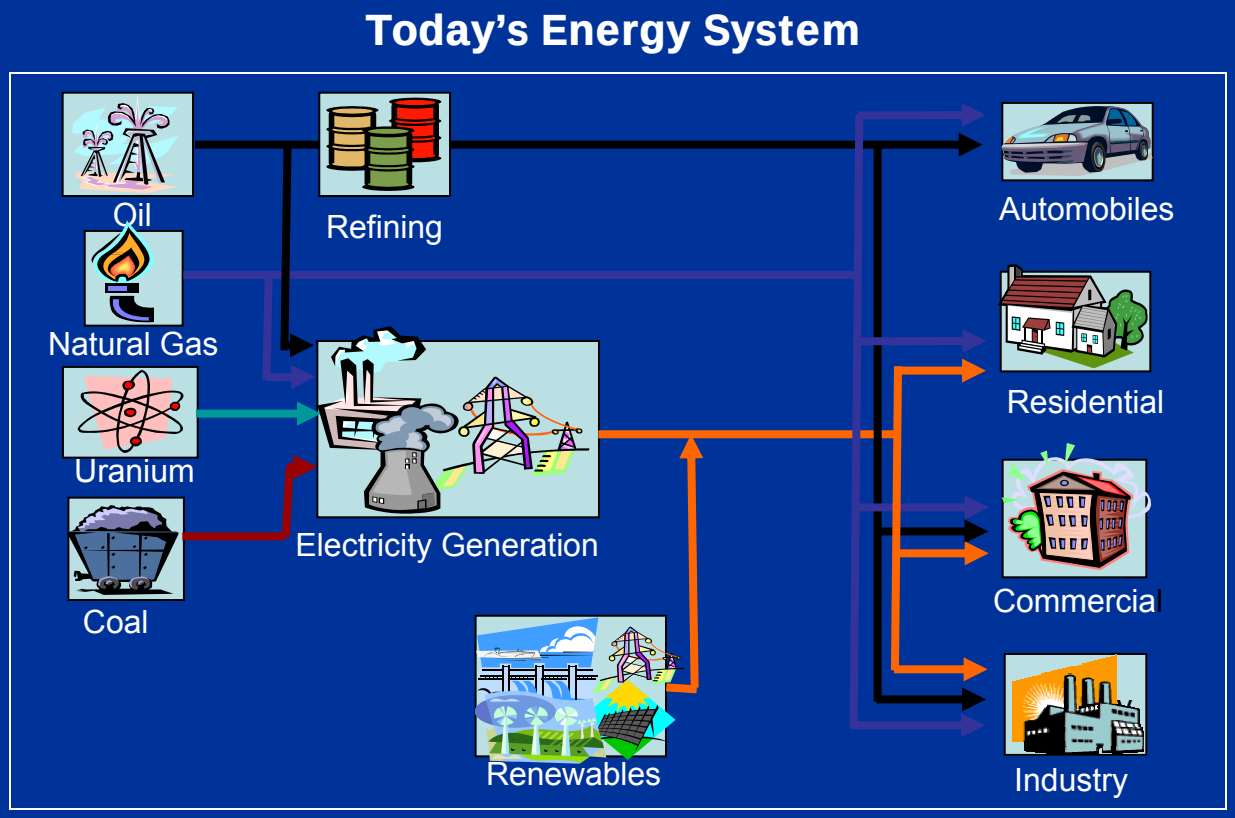
NE-MARKAL: Links Energy and Air Quality



Air Pollution

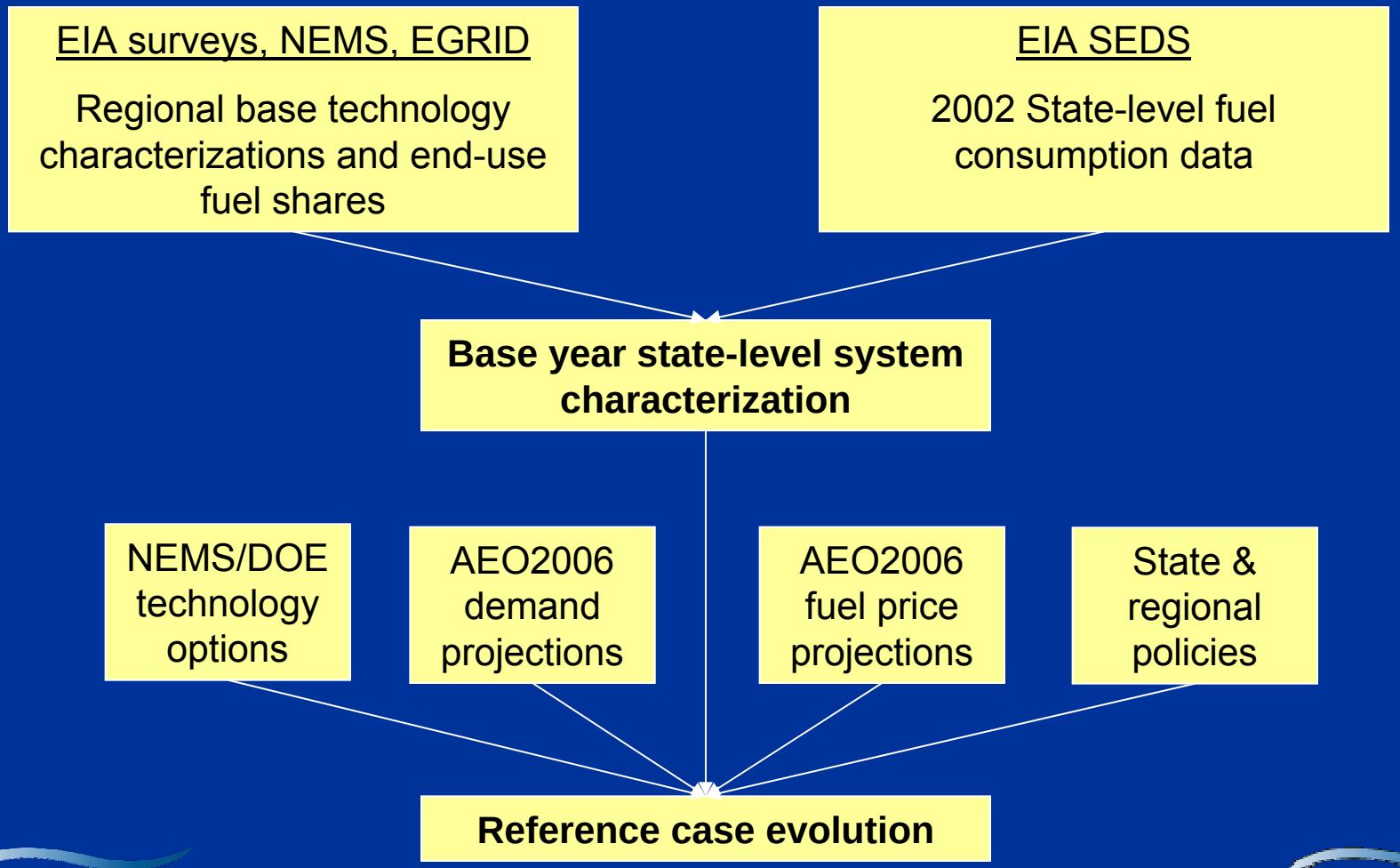
Contribution to anthropogenic emissions:

NOx ~ 95%
SOx ~ 89%
CO ~ 95%
Hg ~ 87%

Air Quality Concerns:
Ozone
PM2.5
Acid deposition
Toxics

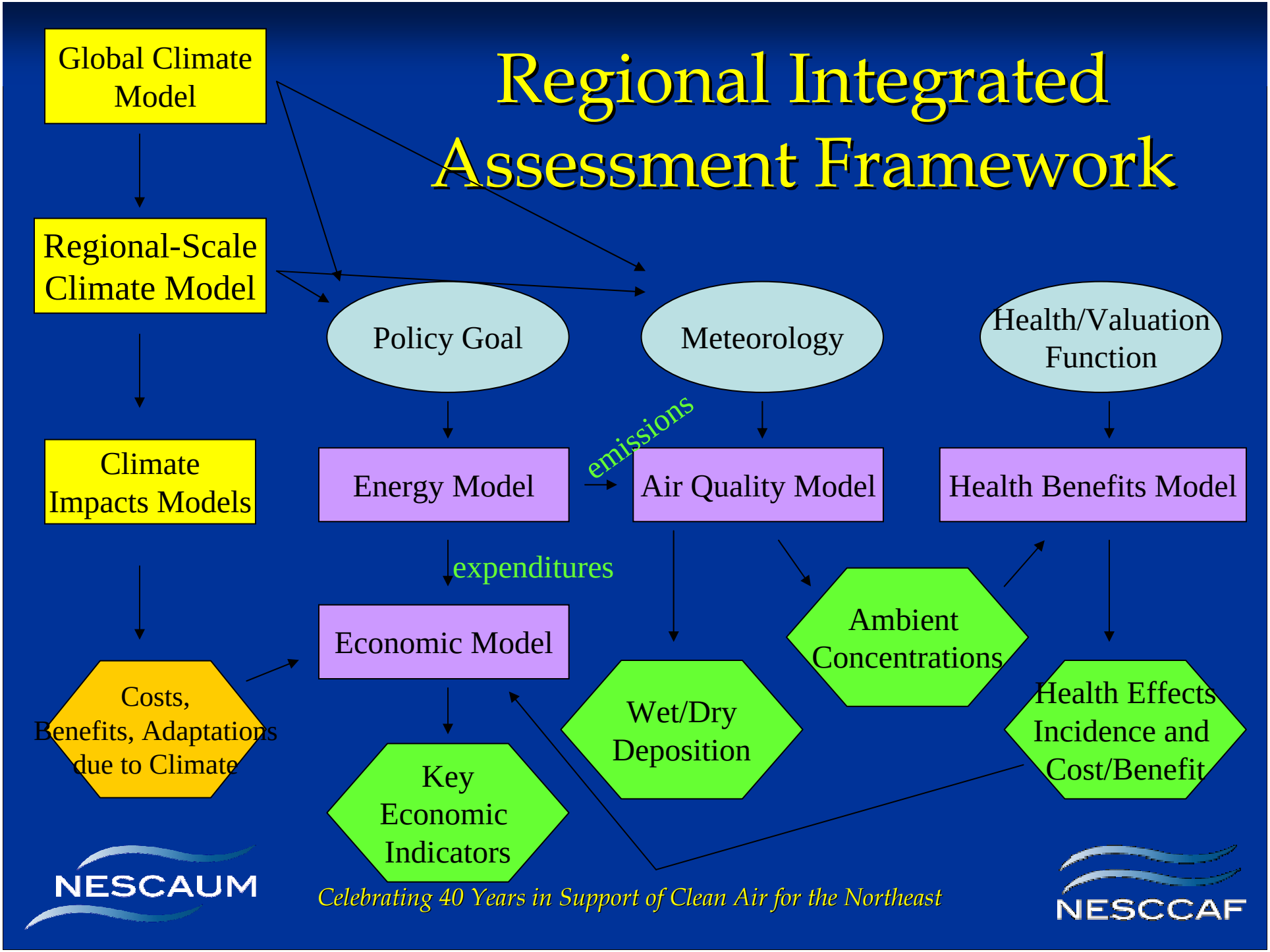
Source: EPA ORD

NE9/12 Data Development Process



NE-9 Demand Sectors Representation

Residential	Space Heating, Cooling, Clothes Washers, Dish Washers, Water Heating, Cooking, Clothes Dryers, Refrigeration, Freezing, Lighting, Personal Computers, Television, Furnace Fans, Other Appliances, Secondary Heating
Commercial	Space Heating, Cooling, Water Heating, Cooking, Ventilation, Refrigeration, Lighting, Office Equipment, Other
Industrial	Steam, Process Heat, Machine Drive, Electro-Chemical, Other, Feedstocks, Non-Energy, and captive CHP in each of Chemicals, Durables, Glass-Cement, Metals, Paper, Other
Transportation	Light and Heavy Duty Vehicles, Other (Aircraft, Marine, Rail available, but not yet implemented)


Regional Integrated Assessment Framework
Global Climate Model
Regional-Scale Climate Model
Climate Impacts Models
Policy Goal
Meteorology
Health/Valuation Function
Energy Model
emissions
Air Quality Model
Health Benefits Model
expenditures
Economic Model
Ambient Concentrations
Costs, Benefits, Adaptations due to Climate
Wet/Dry Deposition
Health Effects Incidence and Cost/Benefit
Key Economic Indicators
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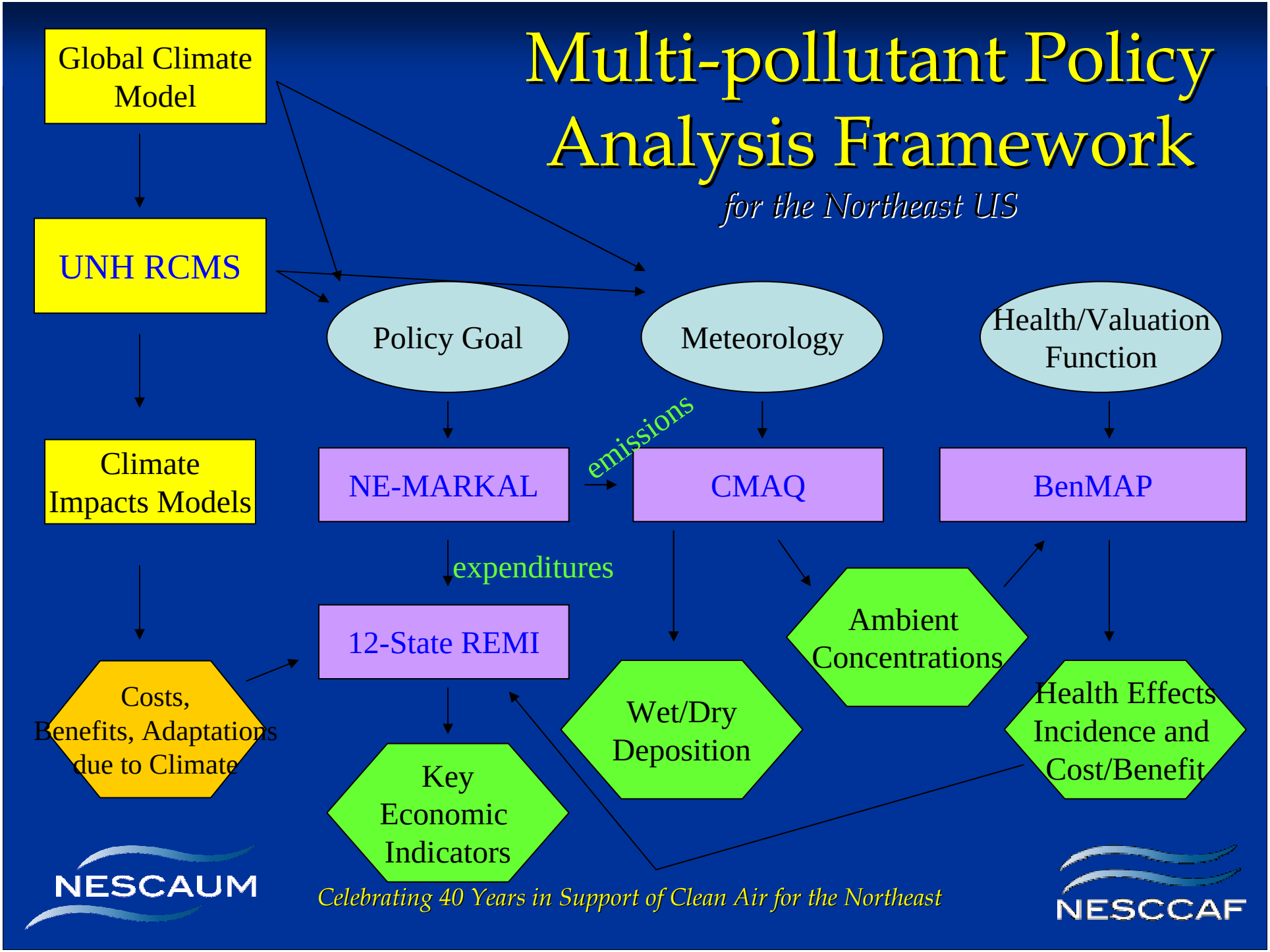
Multi-pollutant Policy Analysis Framework
for the Northeast US
Global Climate Model
UNH RCMS
Climate Impacts Models
Policy Goal
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NE-MARKAL
emissions
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Examples of potential air quality and climate trade-offs and/or interactions

High Energy Demand Days

- Peak energy demand is highly correlated with high temperature and poor air quality (ozone)
- Peak power generation significantly increases NOx emissions on those days that are most conducive to ozone formation
- Controls (Selective Catalytic Reduction) would reduce emissions, but require more energy
- Energy Efficiency would reduce demand *and* reduce emissions

Biomass I

- How can the Northeast U.S. make the best use of its biomass resources?
  - Biomass gasification for power generation?
  - Cellulosic ethanol production for transportation fuels?
  - Biofuels to offset current fuel oil consumption?
  - Biomass-fueled CHP?
- Different technologies = different emissions (both carbon and criteria pollutant emissions)

Biomass II

- Biomass combustion for power generation
- Good technology characterization for carbon emissions
- Need reliable data for NOx emissions
- Does introduction of biomass at larger scale (~100MW) result in net NOx decrease? (may depend on what it replaces)

Concluding Thoughts

- Energy and Air Quality are tightly linked: The same technology that produces, transforms, and delivers energy service ALSO creates air pollutant emissions
- Analysis tools that will successfully address either issue, must be able to account for both aspects of this linkage

Thank You!

The Clean Air Association of the Northeast States

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